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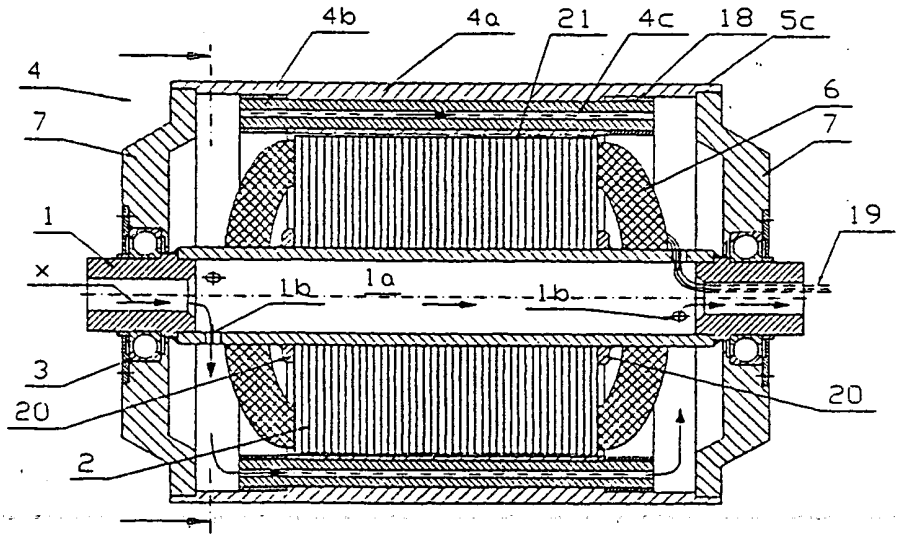

(57) Abstract: The object of this invention is the construction in electric motor drive, where a asynchronous motor, such as drum motor, which has a stator (2) mounted on a non-rotatory shaft (1) and has rotatory, like by means of bearings (3), connected rotor (4), is arranged to drive the machine construction (actuator). The rotor (4) of the asynchronous motor conveyor's is arranged to be directly a functional part of the machine construction (actuator), like conveyor's (5) driving roll (5a). Also the rotor can be formed as a shell of pulley (4) which is part of a vacuum belt conveyor comprising a stationary vacuum box (11), the rotor drive further comprising: said non-rotatory shaft (1) being supported by at least one supporting bracket (8) which is connected to the vacuum box. The object of this invention is also the method for corresponding purpose.

WO 01/37398 A2

Construction and method of an electric motor drive

BACKGROUND OF THE INVENTION

1. Field of the invention

The present invention relates to an electric motor drive and a method for an electric motor drive, and more particularly an asynchronous motor, ~~such as drum motor or similar motor~~, which has a stator mounted on a non-rotatory shaft and a rotor which rotates around the stator. ~~is a rotor, which is rotatory, like by means of bearings, connected on the same shaft and has a short-circuit arrangement, is arranged to drive a machine construction (actuator).~~

2. Description of the related art

~~Above described types of~~ asynchronous, compact drum motors have been presented ~~for example~~ in publications EP 0 582 563, US 4,868,436 and FI 811414. ~~Among these,~~ the first-mentioned solution in these publications is carried into effect by keeping separate and individual copper short-circuit bars in ~~their~~ position by pressing them in place with collars mounted on the end flanges of ~~the~~ a motor.

The disadvantage of this ~~type of solution~~ arrangement is the poor heat transmission from the short-circuit bars to the rotor shell. Further, ~~in the solution of~~ US-patent 4,868,436 ~~the~~ discloses a rotor structure ~~is~~ built up of a so called active part (i.e. electric plate package) and at least two separate rotor shell parts (i.e. support flange) and onto it by means of a screw coupling connected rotor shell, which makes the ~~solution in question~~ arrangement unnecessarily complicated. In application publication EP 0 617 155 there is a much similar solution (of above mentioned U.S.-patent), where a motor's rotor package, ~~which~~ is constructed/laminated of electric plates, and is

connected together with ~~the~~ short-circuiting conductors to a drum roller by means of a screw/press coupling, which operates as a roll surface. ~~Also~~ this solution is disadvantageous especially in manufacturing. Further, in ~~latter~~ Finnish patent application 811414 there is presented a drum motor, which is designed especially for elevator purposes. In this ~~solution~~ application a separate roller with cable grooves, ~~and~~ a brake surface area, for elevator's lifting cables, and brakes ~~is~~ are mounted on the upper shell of the rotor. ~~E.g. in this solution is additionally proposed that~~ the motor cooling is ~~taken care of~~ provided by machining radial ventilation holes in the roller and stator and to blow ~~the~~ cooling air ~~to~~ into the holes with a separate blower.

~~To all of~~ Relative to the above mentioned ~~solutions~~ approaches it is common, ~~that first of all respectively used machine construction~~, for the actuator's connection to the drum motor ~~to~~ requires special mounting arrangements and/or extra parts for ~~it is~~ a separate drive roll to be assembled on to an electrical motor's rotor (EP 0 582 563), a firmly assembled flange arrangement on the motor's frame (US 4,868,436) or a shell to be assembled outside the drum motor (FI 811414 and EP 0 617 155 A1). ~~On the other hand in~~ the motor constructions in the above mentioned innovations ~~the~~ provide for cooling circulation ~~is~~ to be carried out by traditional means. Thus, it is not possible to reach higher outputs than with a standard drum motor. ~~solutions.~~

What is needed in the art is an electric motor drive and a method of constructing an electric motor drive which will provide a higher output.

SUMMARY OF THE INVENTION

The present invention provides an electric motor and a method for constructing an electric motor with a higher output.

The ~~purpose of the construction of this invention~~ is to overcome the ~~above-described~~ disadvantages and thereby essentially improve the ~~level of the technique in this~~ area. It is principally distinctive to the construction of the electric motor of ~~according to~~ this invention, ~~to carry out this purpose,~~ that the functional part of the ~~machine~~ motor's construction, ~~the~~ actuator, ~~like~~ such as a conveyor's driving roll, ~~or similar~~ is arranged to operate by having a short-circuit arrangement as the rotor of the asynchronous motor. In other words: the actuator (e.g. driving roll) is formed ~~so~~ so as to constitute ~~itself~~ the rotor of the asynchronous motor, with the actuator ~~comprising~~ being the short-circuit arrangement.

The construction according to one embodiment of the invention is characterized by ~~that~~ the functional part of the machine construction, the actuator, ~~like~~ such as a conveyor's driving roll, ~~is~~ being arranged to operate by having a short-circuit arrangement as the rotor of the asynchronous motor.

It should be noted that the ~~term~~ arrangement of the actuator ~~comprising~~ being the short-circuit arrangement is referring to many various ~~(or different)~~ embodiments. In the most simple embodiment, the actuator is formed as a one-piece solid roll shell being free from short-circuit bars and rings and also being free from laminated elements.

In another embodiment (also being free from laminated elements) short-circuit bars and rings are provided. Each of the bars and the rings ~~will be~~ are located within the roll shell, preferably with a tight or positive fit

~~(or locking)~~ being provided between each bar and the roll shell, whereby additional mounting elements (e.g. collars and/or screws) are not ~~necessarily~~ needed.

The most important advantages of the construction of this invention is the simplicity of its construction, manufacturing and usage, its efficiency and reliability of working, and ~~which attain~~ the most ~~possible~~ integrated and compact machine configuration ~~which allow to get~~ this configuration allows higher output and higher torque from the ~~used~~ asynchronous massive rotor and a significant ~~to~~ improvement in its performance in other ways ~~too~~ as well. The simplicity of the construction of this invention ~~as advantageous solution~~ is based ~~e.g.~~ on the fact that there is no need to use traditional short-circuiting conductors, since the short-circuit arrangement is established directly into the functional part of the machine construction (actuator), such as a ~~like~~ conveyor's driving roll. On the other hand the structure of this invention makes it possible to use ~~the~~ traditional short-circuiting connectors in a new way, so that they are located ~~essentially~~ internally ~~in~~ to a functional part of the machine construction (actuator) as the rotor shell, such as a ~~like~~ conveyor's driving roll. ~~When applying advantageously the structure of this invention,~~ the asynchronous motor is equipped with primary and secondary cooling circulation to cool both the stator and the rotor, ~~for example so that the~~ cooling fluid is ~~firstly essentially~~ carried through the stator shaft and with the help of ~~the~~ holes in the shaft ~~elsewhere~~ as a parallel flow through the flow system in the rotor shell. As a further improvement, the rotor is manufactured of an electric ~~al~~ conductive compound metal

structure, where copper short-circuit bars or pipes and rings are ~~for example~~ explosion welded into pre-drilled/machined holes/slots. On the other hand during manufacturing of the asynchronous motor it is also possible to utilize ~~also~~ a casting technique.

A further embodiment of the present invention, ~~Further advantageous solution~~ is to assemble the stator on the hollow shaft/pipe which also serves as a stator shaft, ~~also working, that which~~ is used ~~for example~~ to feed over-pressure cooling air. ~~Herewith it~~ this is effectuated by using a hermetic primary cooling method, which is known from EP 0 617 155 and which prevents dirt ~~to~~ from penetrating into the drum motor, which is not possible ~~to prevent~~ with the conventional, ~~effectuated~~ free ~~by open~~ breathing air-cooled solutions. ~~Further advantageous feature is that the~~ A further embodiment of the present invention, provides for short-circuit hollow bars or pipes ~~are~~ to be positioned within the rotor shell, functioning as secondary cooling channels. Thereby ~~it is~~ making it possible to carry ~~the~~ cooling air to the hottest spots of the rotor, which helps ~~in its way significantly~~ both to obtain the maximum output and to increase the amount of starts/stops ~~of~~ the ~~machine construction~~ (actuator) equipped with the motor ~~in question~~ is capable of.

The advantageous solutions of the structure of the invention have been presented in separate independent patent claims.

Object of this invention is also a method for equivalent purpose, which is more specifically described in independent patent claim's introduction

section and whose characteristic features in corresponding patent claim's characteristic section.

The method according to another embodiment of the present invention is characterized by ~~that~~ the functional part of ~~the~~ machine construction, an ~~a~~actuator~~,~~ ~~like~~ such as a conveyor's driving roll, ~~is~~ being arranged to operate by having a short-circuit arrangement as the rotor of the asynchronous motor.

~~One of the most~~ Important advantages of the method of this invention ~~has~~ are ~~is~~ the simplicity of the operating principle~~,~~ ~~and~~ the simple constructions which makes it possible~~,~~ ~~and~~ the reliability of ~~working~~ the device, ~~and which allows to gain~~ the ~~utmost~~ compact machine construction (actuator), ~~unit~~ which is integral~~ly~~ ~~united~~ with an asynchronous motor to achieve high mechanical load capacity, vibration strength, and high starting and operation torque features. The simplicity of the method of this invention ~~as a advantageous solution~~ is based ~~for example~~ on the fact that there is no need to use a separate laminated rotor component with traditional short-circuiting conductors inside a functional part of the machine construction, ~~by establishing~~ rather a short-circuit arrangement is integrated directly into the functional part of the machine construction (actuator), ~~like~~ such as conveyor's driving roll. ~~On the other hand~~ The method of this invention makes it possible to ~~use the~~ utilize traditional short-circuiting connectors, ~~in a new way~~, ~~so that they are~~ located essentially internally on a functional part of the machine construction (actuator) as the rotor shell, ~~like~~ such as conveyor's driving roll.

~~Furthermore as~~ An advantage~~ous development~~ of this innovation, it makes ~~is~~ possible to increase an air gap diameter between a stator and a rotor once a maximum outer diameter and total length of a drum motor is limited. Thus by this innovative design it is possible to get higher output power and higher torque as compared to an asynchronous drum motor having the same main dimensions as this new innovative drum motor construction and having a standard laminated rotor component inside a rotor shell.

A Further~~more as an~~ advantage~~ous development~~ of this method is ~~to~~ the minimization of the manufacturing costs of the ~~here mentioned~~ massive motor ~~for example~~ by manufacturing the rotor and the associated slots ~~by~~ from cast~~ing them of~~ steel.

A further advantage of this is that ~~Applying the~~ method ~~advantageously~~ the asynchronous motor is ~~being~~ cooled effectively ~~to get~~ allowing a higher output than with conventional ~~ones~~ Motors ~~can be reached~~, ~~because correctly carried out i.e. according to~~ this invention provides an ~~realized for example~~ hermetic seal and ~~essentially in~~ an axial~~ly~~ directed ~~direction~~ (trough the asynchronous motor) ~~carried~~, cooling fluid flow~~,~~ which makes ~~it~~ possible ~~for example to direct~~ the directing of ~~over press~~ cooling air to the hottest spots of the rotor, which in turn allows an ~~essential condition both to~~ increase in the maximum output and ~~to~~ an increase~~d~~ ~~the amount~~ number of starts/stops. ~~On the other hand compared to the~~ In contrast to freely breathing air-cooled motors, the present invention ~~solutions this solution~~ prevents ~~especially in hard conditions~~ filth from penetrating into the drum motor structure.

Cooling of an asynchronous motor with a solid rotor can be realised either with or without a secondary cooling arrangement ~~via~~ of hollow bars or tubes inside a functional part of the machine construction (actuator) such as the rotor shell. In ~~such~~ constructions the cooling is taken care of only with a primary cooling arrangement without a secondary cooling arrangement ~~(e.g.~~ air flow arrangement such as an air gap between an inner surface of a rotor shell and an outer surface of a stator component.

Furthermore, it is important that the short-circuit bars and rings ~~belonging advantageously to the short-circuiting adjustment~~ are arranged essentially integral with rotor shell, ~~i.e.~~ at least partly or ~~then~~ even totally, with internal arrangements. ~~and thus also~~ Such an arrangement provides for a much more efficient heat ~~conduction than present,~~ transfer between the steel shell and the copper short-circuit bars and rings than can be accomplished ~~than~~ with ~~the~~ traditional solutions. This also ~~gives better possibilities~~ allows for higher output and ~~to~~ an increase in the number of starts and stops of the asynchronous motor within a ~~certain~~ time interval.

Advantageous solutions of the method of the invention have been presented in separate independent patent claims.

BRIEF DESCRIPTION OF THE DRAWINGS

The invention is in more detail presented in the description and the attached drawings.

Figure 1 presents

a longitudinal cross section of a typical machine construction (actuator) unit, which is accomplished with the method in this invention and

Figure 2 presents a cross-sectional profile of ~~spots~~ a section along line "Fig 2 - Fig. 2" in Figure 1.

Figures 3a - 3C present some alternative massive motor constructions of a drum motor.

Figures 4 and 5 present a drum motor designed according to the present one embodiment of invention and integrated to one end of a vacuum belt conveyor construction, with Fig. 5 being a section along line V - V of Fig. 4.

DETAILED DESCRIPTION OF THE INVENTION

Now to the drawings & more particularly Referring to Figures 1 to 3, ~~the object of this invention is a~~ there is shown the construction of an electric motor drive, the electric motor drive being where a so called solid asynchronous motor, which has ~~a~~ stator 2 mounted on ~~a~~ non-rotatory shaft 1 and around ~~the~~ stator is ~~a~~ rotor 4, which is, ~~like~~ by means of bearings 3, rotatably connected on ~~the same~~ shaft 1 and having ~~has~~ a short-circuit arrangement is designed to drive a machine construction (actuator). The functional part of the machine construction (actuator), ~~like~~ such as conveyor's 5 (fig. 4) driving roll 5a, ~~or~~ 5b or 5c, is designed to operate by an integrally connected short-circuit arrangement ~~as the~~ of rotor 4 of the asynchronous motor. ~~Especially in~~ Figure 3c ~~is~~ shows the most simple ~~structure~~ embodiment of the invention, in which conveyor's driving roll 5a is realized with a

Driving roll 5a

solid shell, ~~which~~ operates directly as the short-circuit arrangement of ~~the~~ rotor 4 without any traditional laminated rotor component ~~with~~ having short-circuit conductors (e.g. short-circuit bars and rings). ~~The solution according to~~ An alternate embodiment of this principle is ~~also~~ shown in Figure 3b, where driving roll 5b is designed to operate as the rotor of the asynchronous motor with the solid shell having on its inner surface drilled or machined holes or grooves 5d.

Different from Figures 3b and 3c, the invention may be advantageously used in connection with the structure, where the short-circuit arrangement ~~can be~~ realized in ~~the~~ rotor's shell 4a with short-circuiting conductor bars 4b and rings 18. In this ~~connection~~ embodiment of the present invention short-circuiting connector bars 4b and rings 18 are arranged to operate at least partly internally of ~~the~~ rotor's shell 4a operating as a functional part of the machine construction (actuator), such as conveyor's driving roll 5c. ~~This type of solutions are presented especially~~ Examples of this embodiment are shown in Figure 2, where round short-circuit bars 4b are ~~being~~ used and in Figure 3a where quadrangular short-circuit bars 4b' are ~~being~~ used in rotor shell 4a'. ~~The~~ Bars 4b as shown in Fig~~ure~~ 2 may be hollow, so that each bar ~~comprises~~ includes a channel 4c for piping cooling fluid. At each end of shell 4a, a flange 7 is provided which connects the shell to one of the bearings 3.

Referring now to yet another embodiment of the invention ~~In~~ Fig~~ure~~ 3a ~~is~~ then is shown ~~a design~~, where conveyor's driving roll 5a is realised by a solid shell having quadrangular short-circuit bars on its inner surface. This type of electrical motor design should be used

when a compact drum motor constructions (e.g. maximum outer diameter and total length of the drum motor are limited) with high output power and torque are desired. Such a compact drum motor is needed in vacuum belt conveyors used for "tail threading" in paper machines.

A typical design of drum motor's stator component 2 consists typically a pile of 0,3 - 1,0 mm thick electrical sheets 21 which are mounted on a stationary hollow shaft 1 and fixed at their position by spot welding stator end plates 20 to the stationary hollow shaft 1. Stator windings 6 are connected via electrical connection cable 19 to an external electric grid.

Referring now to Figures 4 and 5 there is shown one end of a vacuum belt conveyor including an endless air pervious belt 10 which travels across two rotary pulleys, only one pulley 4 being shown. The pulleys are supported by a vacuum box 11. Therein a negative pressure is created by a vacuum source (not shown). The negative pressure propagates through openings 12 of a cover plate 13 and through belt 10 in order to convey a web of paper or similar material, in particular a lead strip or "tail" which has been separated from threading purposes (see e.g. US patent 3,355,349).

In order to drive the belt 10, a pulley 4 is designed as the rotor of an electric motor drive according to the present invention. Similar to Figure 1, a stationary hollow shaft 1 supports a stator 2 and (by means of bearings 3) the rotor 4, - which is the pulley 4

of the vacuum belt conveyor and which ~~again~~ comprises a rotor shell 4a and two end-flanges 7.

Preferably, the following measures may be provided in order to adapt the electric motor drive to the demands of a vacuum belt conveyor:

~~The~~ width W of conveyor 5 (and also ~~the~~ length L) of the pulley's shell 4a should be relatively small, about 0,25 m. The pulley's diameter should preferably be less than 0,15 m. ~~On the other hand,~~ the speed of ~~the~~ belt should be about the same as the operating speed of modern paper machines which may exceed 2000 m/min. Therefore, there is a need for very high motor output while the dimensions of the motor drive should be relatively small.

To fulfil these demands, ~~the~~ distance D between the bearings 3 is larger than ~~the~~ length L of ~~the~~ pulley's shell 4a, in order to increase the internal space being available for stator 2 and for the short-circuit arrangement of ~~the~~ rotor 4. As a consequence, each flange 7 is formed as a bushing which bridges the difference between length L and distance D. Furthermore, each of ~~the~~ supporting brackets 8 which connect ~~the~~ stationary shaft 1 to the side walls of ~~the~~ vacuum box 11 is formed similar to a 'Z' (in other words: it is "double folded"). In addition, each support bracket 8 may be wrapped around the periphery of one of ~~the~~ flanges 7.

In order to improve the cooling effect, ~~the~~ hollow shaft 1 comprises at one of its ends an internal (e.g. coaxial) supply channel (15) as well as a discharge channel 16, as a result, ~~the~~ cooling fluid X must pass the inner side of stator 2 as well as its outer side and the inner side of ~~the~~ rotor 4 (plus the channels 4c, if existing, in ~~the~~ bars 4b as shown in Fig~~ure~~ 1).

~~Also, the following is advantageous.~~ The above mentioned supporting brackets 8 can be used also as a connection surface for vacuum belt conveyor's accessories (e.g. knife plates, rotary rippers and choppers) (which ~~is~~ are not shown ~~as practical solution~~ in the ~~enclosed~~ drawings).

In addition to the ~~things mentioned above~~ foregoing, the cooling of the machine construction (actuator) operating as ~~a~~ rotor 4 of a asynchronous motor is realized ~~advantageously~~ mainly with primary cooling by carrying over-press cooling air X in an axial direction through ~~the~~ stator shaft 1, which can be for example a hollow shaft, pipe or similar during and ~~it~~ stator shaft 1 is equipped with ~~its~~ a first flow arrangement 1a. ~~On the other hand when using advantageously the structure of this invention~~ It is possible to boost the cooling of the asynchronous motor ~~besides~~ beyond what ~~was~~ is described ~~earlier~~ above or instead of it by way of ~~also with~~ secondary cooling ~~by equipping the~~ which employs short-circuiting bars 4b' with ~~another~~ flow arrangement 4c. Then, ~~for example,~~ it is possible to carry cooling air X in an axial direction through ~~the~~ hollow copper short-circuit bars 4b, ~~for example,~~ according to the principle in Figure 1 with the help of ~~the~~ holes 1b in ~~the~~ stator shaft 1 together with ~~the~~ primary air flow

1a which take place together with the parallel flow to the hottest spots of the rotor, which enables a higher output from the machine construction (actuator) and especially to allow more short run starts/stops.

Once an asynchronous motor has a solid rotor's cross section as shown in Figures 3a, 3b and 3c, cooling is taken care of by an air flow arrangement through an air gap located between an inner surface of a rotor shell 5a, 5b, 5c and an outer surface of stator component 2.

Yet another embodiment of the present invention is to manufacture the rotor of electrically conductive compound metal structure, where copper short-circuit bars 4b; 4b' are integrally connected to steel rotor shell 4a; 4a' for example by explosion welding or by centrifugal casting.

It is possible with the asynchronous motor, realized according to the invention, when using star type coupling for windings, to get the output of the drum motor equipped with three, four, or six pole stator windings which reach the level 0.5 - 500 kW and to have the speed of rotation typically in the area of 0 - 20000 rpm.

Yet still a further embodiment of the present invention (which is not shown in the drawings) there may be provided a frequency transformer for use by the asynchronous motor, which is equipped with active rotation speed control. In this embodiment rather

traditional solutions can be used to achieve the ~~wanted~~ desired effect.

And, in yet another embodiment of the present invention ~~The object of this invention~~ is ~~also~~ a method with an electric motor drive, where the machine construction (actuator) ~~is~~ used ~~by~~ an asynchronous motor, such as a drum motor, which has ~~a~~ stator 2 mounted on ~~a~~ non-rotatory shaft 1 and around ~~the~~ stator 2 is ~~a~~ rotor 4, which is rotatable, ~~like by means of~~ having bearings 3, connected on ~~the same~~ shaft 1 and ~~has~~ with a short-circuit arrangement. The functional part of the machine construction (actuator), ~~such as~~ such as conveyor's 5 driving roll 5a, is arranged to operate by having a short-circuit arrangement as ~~the~~ rotor 4 of the asynchronous motor (typical constructions shown in Figures 2 and 3a). The method according to this principle is applied in ~~the~~ simplest way ~~for example~~ in constructions as shown in Figure 3b, wherein driving roll's 5b machined grooves/slots 5d are arranged as the short-circuit arrangement. On the other hand in Figure 3c is a similar type of solution without traditional short-circuit bars, wherein ~~the~~ driving roll 5a is realized as a solid shell, which operates directly as the short-circuiting arrangement.

As a further embodiment ~~Furthermore as an advantageous application~~ of this method it is advantageous to benefit ~~in~~ the machine construction with an asynchronous motor, whose short-circuit arrangement is connected to ~~the~~ rotor 4, ~~like~~ such as short circuiting bars 4b and rings 8 which are supported on rotor's shell 4a. In this connection short-circuit bars 4b and rings 8 ~~belonging to the short-circuit arrangement~~ are arranged to operate at least partly internally ~~as the~~ to rotor ~~of~~ 4 shell 4a of the operating functional part of the machine.

construction (actuator), such as conveyor's driving roll 5a. In this ~~connection~~ embodiment ~~this type of solution is~~ as presented, ~~especially~~ in Figure 2, showing round short-circuit conductors 4b and further in Figure 3a showing quadrangular short-circuit bars 4b'.

Furthermore referring to Figure 1 this method can be used with an asynchronous motor which is arranged to be cooled ~~by having~~ with a fluid flow. The cooling of the asynchronous motor is realized as a closed system by carrying a cooling fluid, such as over-press cooling air X, hermetically ~~essentially~~ in an axial direction in ~~a~~ primary flow arrangement 1a through ~~the~~ stator shaft 1 ~~like~~ such as a hollow shaft, pipe or similar device. ~~On the other hand~~ The cooling of the asynchronous motor can be arranged ~~instead~~ in a manner other than that ~~of as~~ described above by carrying a cooling fluid, such as over-press cooling air X hermetically ~~essentially~~ in an axial direction in a secondary flow arrangement 4c provided in short-circuit conductors 4b, ~~like~~ such as hollow bars or pipes.

~~Especially~~ Referring to Fig~~ure~~ 1, ~~as an example~~. Rotor 4 of the solid asynchronous motor is manufactured of an electric(ally) conductive compound metal structure, ~~when~~ with ~~advantageously, for example~~, copper short circuit bars 4b which are welded, ~~like~~ such as explosive welded or butt welded into the holes in ~~the~~ steel rotor shell 4a or that they are cast integral ~~with a most suitable~~ using a casting method, ~~like~~ such as a press casting method. ~~(solution is not presented in Figure 1)~~. ~~With~~ In the above mentioned methods with a cast assembly wherein every short-circuit bar 4b and ring 18 is integrated as an integral part of rotor shell 4a, ~~which~~ this arrangement allows ~~to achieve~~ better heat transmission between the

steel shell and copper short-circuit conductors. This fact ~~has a~~ is of great importance when trying to get higher maximum power from the machine constructions (actuators) than with traditional solutions and especially when short run starts/stops are ~~in question.~~ numerous. The same is true with the embodiment shown in Figure 3a comprising rotor shell 4a' and bar 4b'.

It is obvious that this invention is not limited to the above mentioned or explained solutions, it can be considerably modified within it's basic idea. Thereby it is possible ~~firstly~~ to utilize the construction or arrangement of this invention in ~~most~~ different manners ~~connections~~, whereupon the dimensions and constructions can considerably differ from the hereby presented example drawings. ~~On the other hand~~ Furthermore, other types of fluids can be used in the cooling of the asynchronous motor realized according to the invention or the cooling can be done differently from what is presented above.

Claims

1-3

1. A construction in electric motor drive, where an asynchronous motor, such as drum motor, which has a stator (2) mounted on a non-rotatory shaft (1), and around the stator is a rotor (4), which is rotatory, like by means of bearings (3), connected on the same shaft (1) and has a short-circuit arrangement, is designed to drive a machine construction (actuator), characterized in that the functional part of the machine construction (actuator), like conveyor's (5) driving roll (5a, 5b, 5c), is arranged to operate by having short-circuit arrangement as the rotor (4) of the asynchronous motor.

4

2. The structure as claimed in claim 1, wherein the short-circuit arrangement is established by the short circuiting bars (4b, 4b') and rings (18) supported on the rotor's shell (4a,4a'), characterized in that the short-circuiting bars (4b, 4b') and rings (18) belonging to the short-circuit arrangement are arranged integral with the rotor's (4) shell (4a, 4a'), which is a functional part of the machine construction (actuator), like conveyor's driving roll (5).

5,6

3. The structure as claimed in claim 1 or claim 2, wherein an asynchronous motor is arranged to be cooled by having a fluid flow, characterized in that the cooling of the asynchronous motor is realized in a closed system, by carrying cooling

fluid, such as over-press cooling air (x) hermetically essentially in axial direction with it's primary flow arrangement (1a) through the stator shaft (1) like hollow shaft or pipe and/or with secondary flow arrangement (4c) through short-circuit conductors (4b) like hollow bars or pipes.

4. The structure as claimed in any of the claims 1-3, characterized in that the rotor (4) of the solid asynchronous motor comprises an of electric conductive compound metal manufactured structure, preferably comprising copper short circuit conductors (4b, 4b'), which are welded by explosive welding, butt welding into the holes in the steel rotor shell (4a, 4a') or that they are cast integral with the rotor shell in their places by a suitable casting method (e.g. centrifugal casting method).

5. The structure as claimed in any of the claims 1-4, characterized in that that when using especially star type coupling for windings, the output of the asynchronous motor equipped with three, four, or six pole stator windings is 0,5 - 500 kW having speed of rotation 0-20 000 rpm.

6. The structure as claimed in some of the claims 1-5, characterized in that the asynchronous motor is having a frequency transformer drive, which is equipped with an active rotation speed control.

7. The structure as claimed in some of the claims 1-6, characterized in that the rotor is

formed as a shell of a pulley (4) which is part of a vacuum belt conveyor (5) comprising a stationary vacuum box (11), the rotor drive further comprising: said central shaft (1) being supported by at least one supporting bracket (8) which is connected to the vacuum box (11).

8. The structure as claimed in some of the claims 1-7, characterized in that the drum motor's supporting brackets (8) can be used also as a connection surface(s) of the vacuum belt conveyor's accessories (e.g. knife plates, rotary rippers and choppers).

9. The structure as claimed in claim 7, characterized in that the distance D between the bearings (3) supporting the pulley (4) is larger than the length L of the pulley's shell (4a).

10. The structure as claimed in claim 9, wherein each flange (7) which connects an end of shell (4a, 4a') to one of the bearings (3) is formed as a bushing which bridges the distance between length L and D.

11. The structure as claimed in claim 9, wherein each supporting bracket (8) - seen in a longitudinal section of the conveyor (5), in Figure 5 - is formed double-folded similar to a Z.

12. Method for electric motor drive, where a machine construction (actuator) used by an asynchronous motor, such as drum motor, which has a

stator (2) mounted on a non-rotatory shaft (1) and around the stator is a rotor (4), which is rotatory, like by means of bearings (3), connected on the same shaft (1) and has a short-circuit arrangement, characterized in that the functional part of the machine construction (actuator), like conveyor's (5) driving roll (5a), operates by having short-circuit arrangement as the rotor (4) of the asynchronous motor.

13. Method as claimed in claim 12 with asynchronous motor, where the short-circuit arrangement is realized in connection with the rotor (4) like having short-circuit conductor bars (4b, 4b') and rings (18) supported on the rotor's shell (4a), characterized in that to the short-circuit arrangement operate at least partly internally as the rotor's (4) shell (4a, 4a') of the operating functional part of the machine construction (actuator), such as conveyor's driving roll (5a, 5b, 5c).

14. Method as claimed in claim 12 or 13 wherein a asynchronous motor is cooled by having a fluid flow, characterized in that the cooling of the asynchronous motor is realized as closed by carrying cooling fluid, such as over-press cooling air (x) hermetically essentially in axial direction with it's primary flow arrangement (1a) through the stator shaft (1) like hollow shaft or pipe and/or through with secondary flow arrangement (4c) equipped short-circuit conductors (4b') like hollow bars or pipes.

15. Method as claimed in some of the claims 12-14, characterized in that the rotor (4) of the solid asynchronous motor is manufacture of electric conductive compound metal structure, whenupon most suitable are copper short circuit conductors (4b, 4b'), which are connected into the holes and/or grooves by welding, like explosive welding or butt welding in the steel rotor shell (4a, 4a') or that they are cast integral within the rotor by a suitable casting method, like centrifugal casting method.

16. Method as claimed in some of the claims 12-15, characterized in that the rotor is formed as a shell of a pulley (4) which is part of a vacuum belt conveyor (5) comprising a stationary vacuum box (11), the rotor drive further comprising: said central shaft (1) being supported by at least one supporting bracket (8) which is connected to the vacuum box (11).